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Abstract

The relationship between school size and academic achievement of African-American secondary school students was examined. Data were drawn from the Texas Academic Excellence Indicator System for 1998, 1999, and 2000. Results showed greater academic achievement for African-American students from large schools than for African-American students at medium and small schools. These findings were most consistent on nationally standardized tests. Results were least consistent for state wide tests and for end of course grades, but all differences found favored large schools. Higher attendance rates were found for students in small schools, but no differences were found for dropout or graduation rates. Regardless of relative differences related to school size, the absolute level academic achievement was unacceptably low. Results are discussed in terms of the conditional effects of school size on minorities and possible changes in the effects of school size related to recent educational reforms.

Introduction

The student enrollment of many secondary schools in the United States will continue to increase in the foreseeable future. This increase will be caused primarily by a projected 6% increase in student enrollment at the national level (National Center for Educational Statistics, 1998) but will also be caused by the resurgent popularity of school consolidation as a cost cutting measure. Some states, such as Texas, are projected to have increases of over 20% (National Center for Educational Statistics). These increases are important because secondary school size has been found to be related, albeit in a complex manner, to students' academic achievement and attendance rates. These complexities have led to inconsistent results because researchers have often failed to control for confounding factors such as race and social class. If there is a trend, however, it has been for the most recent researchers to find an inverse relationship between school size and students' achievement (see Cotton, 1997; Greenwald, Hedges, & Laine, 1996; and Slate & Jones, 2005 for reviews of this literature).

Because race tends to be a confounding factor in studies of school size, large scale studies examining the relationship between school size and the academic achievement of racial minority students are clearly needed. To date, however, no large studies have been conducted in which the relationship between school size and minority students' academic achievement was the specific focus of the study. Because African-American students may be particularly susceptible to deleterious effects of increased school size (Slate & Jones, 2005), these students were chosen as the focus of the present study. Two specific research questions were addressed. First, is there a statistically significant relationship between school size and the academic achievement of African-American secondary school students? This question was addressed in terms of scores on nationally standardized tests (i.e., ACT and SAT I scores), state level standardized test scores (i.e., Reading, Mathematics, and Writing on the Texas Assessment of Academic Skills [TAAS]), and end-of-course exam passing rates in Algebra I, Biology, English II, and History. The second research question asked if there is a statistically significant relationship between school size and both the attendance rates and the persistence in school of African-American secondary school students.

Method

Sample

Data were drawn from the Texas Academic Excellence Indicator System (AEIS) published annually by the Texas Education Agency (TEA). These data were gleaned from a computer disk provided by the TEA and from the TEA Website. The sample consisted of high schools with a 9-12 grade configuration for each of the previous three years as of the Fall Semester, 2001. Schools with other grade configurations (e.g., 7-12, 10-12) were excluded from the study as were charter schools and alternative placement schools. Unfortunately, a cross check of data available on the disk and data on the TEA Website revealed inconsistencies in coding for 35% of the schools in the database. As a result, these schools were also excluded from the analyses because we could not determine which coding was accurate. Thus, the results are based on a sample of approximately 65% of all Texas high schools with a traditional 9-12 grade configuration.

School Size

For the purposes of analysis schools were divided into three size categories based upon definitions developed by Green and Barnes (1993). According to these definitions, small schools have between 100 and 799 students, but the smallest schools in the present sample had at least 400 students. Medium schools had enrollments between 800 to 1199 students, and large schools had enrollments of 1200 or more students. The number of schools in each category for each year analyzed is presented in Table 1. The numbers vary from year to year due to errors in the database and because a minimum of 5% of the students in a school must be in a given category before the TEA will report information broken down by that category. There were schools that met this reporting criterion in some years but not others. Thus 493 schools were available for analysis from 1998, 351 from 1999, and 502 from 2000.

Academic Achievement

Standardized indicators of academic achievement reported on the AEIS include nationally standardized college admissions scores on the SAT I and the ACT, and scores on the Texas Assessment of Academic Skills (TAAS). The TAAS provides scores in reading, writing, and mathematics. Texas recognizes exit level scores on the TAAS as a measure of successful completion of high school and gives high schools either a favorable or unfavorable accountability rating based on these scores. Unstandardized measures reported on the AIES include scores on end-of-course exams in Algebra I, Biology, English II, and U.S. History. These end-of-course exams are designed to measure knowledge and skills at levels representative of the sophomore year, and are aligned with the Texas Essential Knowledge and Skills learning objectives. Students may be exempt from TAAS testing by obtaining a high score on the end-of-course exams the previous year. Data on school attendance, graduation, and dropout rates are also provided.

Social Class

Data on the number of students receiving free or reduced price lunches are also available from the AEIS database. This variable was included as a measure of social class. This measure reflects the entire population of the school because AEIS does not provide a breakdown of this variable by race.

Results

Because of the wide variation in the schools available for analysis, data were analyzed separately for each of the there years. Similarly, simultaneous analysis of all outcome variables would have resulted in greatly reduced sample sizes. Thus, results for these variables were conducted in several blocks. Results for national standardized tests are presented first. Results for the TAAS scores are presented next; followed by the results for end of course exams; and finally the results for attendance, dropout rates, and graduation rates.

To detect possible confounds between school size and social class a univariate analysis of variance (ANOVA) was conducted using school size as the predictor variable and the percent of students on free or reduced lunches as the criterion variable. The result was not statistically significant at the .05 level for any of the three years. Means and standard deviations are presented in Table 2. Thus, social class was not used as a control variable in any of the subsequent analyses.

Nationally Standardized Test Scores

To prevent low sample sizes, scores on the SAT I and ACT had to be analyzed separately. Thus separate univariate analyses of variance (ANOVA) were conducted for each test for each year. Statistical significance for all tests was set at the .05 level. Although this increases the risk of Type I errors, we considered this risk to be acceptable for two reasons. First, this study represents an initial large scale examination of the effects of school size on African-American students. Any findings will require independent replication. Unfortunately, when statistical significance is not obtained, researchers often lose interest in examining a phenomenon (Johnston & Pennypacker, 1993). Thus, we considered the risk of Type II errors to be even greater than the risk of Type I errors. Furthermore, Type I errors are unlikely to have a consistent pattern across three years analyzed separately which reduces the possibility of over interpreting results due to Type I errors.

Analysis of SAT I scores. The means and standard deviations for SAT I scores are presented in Table 2. The ANOVAs revealed statistically significant differences by school size in 1998, F (2, 234) = 17.44, $p < .001$, in 1999, F (2, 234) = 17.92, $p < .001$, and again in 2000, F (2, 161) = 8.55, $p < .001$. Effect sizes of .39, .39, .and 33 were found for the three years respectively which are in the moderate range (Cohen, 1988). Scheffe post hoc tests revealed that in all three years African-American students in the large size schools had higher SAT I average scores than did African-American students in both the small and medium size schools.

Analysis of ACT scores. Means and standard deviations for ACT scores are presented in Table 3. The pattern of results was identical to the results for the SAT I. Statistically significant differences were found by school size in 1998, F (2, 194) = 6.84, $p < .001$, in 1999, F (2, 194) = 7.52, $p < .005$, and in 2000, F (2, 161) = 4.90, $p < .05$. Moderate effect sizes of .26, .28, and .25 were found for the three years respectively. Scheffe post hoc tests again revealed that ACT scores were higher all three years for African-American students in the large schools than in the small and medium size schools.

Texas Assessment of Academic Skills Scores

The percentages of African-American students passing the TAAS each year in reading, writing and math are presented in Table 4. Samples sizes were sufficient to permit multivariate analysis of scores for each year. In 1998 a significant difference was obtained, Roy's Largest Root F (3, 341) = 8.62, $p < .001$, with a moderate effect size of .27. Follow-up univariate ANOVAs revealed a statistically significant difference in reading, F (2, 342) = 7.37, $p < .001$, but the effect size of .21 was small. The ANOVAs for math and writing, however, were not statistically significant with ps > .05. Scheffe post hoc tests of the reading revealed that African-American students in the large size schools outperformed African-American students in both the small and medium size schools.

The MANOVA of TAAS scores for 1999 was not statistically significant at the .05 level. As a result, follow-up ANOVAs were not performed.

The MANOVA for TAAS scores for 2000 was statistically significant, Roy's Largest Root F (3, 339) = 2.83, $p < .05$. The effect size of .16, however, was small and the follow-up ANOVAs were not statistically significant for reading, writing, or math.

End of Course Exams

The percentage of African-American students passing end of course exams is presented in Table 5. Sample sizes were large enough to permit a MANOVA for each year. Unfortunately, at the time of the analysis, end of the year passing rates in 1998 were not available for English II or U.S. History. The MANOVA performed on passing rates for Algebra I and Biology, however, was statistically significant, Roy's Largest Root F (2, 332) = 6.84, $p < .001$ with a small effect size of .2. Follow-up univariate ANOVAs revealed statistically significant differences in both Algebra I, F (2, 332) = 4.17, $p < .05$ and in Biology, F (2, 332) = 6.10, $p < .005$, with effect sizes of .16 and .19, respectively. Scheffe post hoc tests revealed that African-American students in larger schools performed better in both subjects than did African-American students in either small or medium sized schools.

In 1999 the MANOVA was statistically significant, Roy's Largest Root F (4, 297) = 5.38, $p < .001$, with a moderate effect size of .27. Follow-up ANOVAs were statistically significant for Algebra I, F (2, 299) = 5.15, $p < .01$, English II, F (2, 299) = 3.47, $p < .05$, and U. S. History, F (2, 299) = 9.36, $p < .001$. The effect size was moderate for U.S. History (.25), but small for Algebra I (.18) and English II (.15). Contrary to 1998, the analysis for Biology was not statistically significant, $p > .05$. Scheffe post hoc tests revealed that African-American students in the large size schools outperformed African-American students in the small and medium size schools in all three subjects for which statistically significant differences were found.

In 2000 the MANOVA was again statistically significant, Roy's Largest Root, F (4, 297) = 9.59, $p < .001$, with a moderate effect size of .36. Follow-up ANOVAs for Algebra I, F (2, 299) = 4.69, $p < .05$ and U.S. History, F (2, 299) = 16.12, $p < .001$ were statistically significant. . The effect size for Algebra I was small (.18) but the effect size was moderate for U.S. History (.33). The ANOVAs were not statistically significant for Biology or for English II, ps > .05. Scheffe post hoc tests revealed that African-American students in the large size schools outperformed African-American students in the small size schools in both Algebra I and U.S. History. African-American students in medium size schools did not differ significantly from African-American students in either small or large schools.

In summary, African-American students in large schools had significantly higher Algebra I passing rates than those African-American students in small schools in all three years, and higher passing rates than those African-American students in medium size schools in two of three years. These effects were small. African-American students in large schools also out-performed those African-American students in small schools in both years for which U.S. History data were available, and this effect was moderate. Those African-American students in large schools, however, out-performed those in medium schools in history in only one of the two years. Although a difference in Biology favoring African-American students in large schools was found in 1998, this difference disappeared in the subsequent two years. Similarly, a difference favoring African-American students in large schools was found for English II the first year for which data were available and then disappeared the following year.

Attendance and Persistence

The AEIS did not have complete attendance, graduation, and dropout rate data available for any of the years studied at the time of analysis. The available data are presented in Table 6. In 1998 only attendance and dropout rates were available. The MANOVA revealed a statistically significant overall effect for school size, Roy's Largest Root F (2, 490) = 27.72, $p < .001$, with a moderate effect size of .34. Follow-up univariate Fs revealed a statistically significant difference in the 1998 attendance rates, F (2, 490) = 20.99, $p < .001$, with a moderate effect size of .29. The result of dropout rates was not statistically significant, $p > .05$. Scheffe post hoc tests revealed that African-American students in small schools had higher attendance rates than did African-American students in medium and large size schools.

Only attendance and graduation rates were available for 1999. The MANOVA revealed a statistically significant result, Roy's Largest Root F (2, 312) = 23.03, $p < .001$, with a moderate effect size of. 38. Follow-up univariate Fs revealed a statistically significant difference in attendance rates, F (2, 312) = 22.98, $p < .001$, with a moderate effect size of .38. No statistically significant effect was present for graduation rates, $p > .05$. Scheffe post hoc tests revealed that African-American students in the small and medium size schools had higher attendance rates than African-American students in the large size schools.

Only the dropout rate was available for 2000. A univariate analysis of variance (ANOVA) did not reveal a statistically significant difference in African-American students' 2000 dropout rates, $p > .05$. Means and standard deviations are presented in Table 2.

Discussion

The purpose for this study was to examine the relationship between school size and the academic achievement of African-American students. Although results vary to some degree depending upon the particular measure of achievement used, results generally favored large schools of 1200 of more students. This result is somewhat surprising given that most recent researchers have favored smaller schools (Cotton, 1997; Greenwald, Hedges, & Laine, 1996; and Slate & Jones, 2005). Interpretation of these results, however, should be tempered by the fact that the smallest schools included in the study had enrollments of over 400 students. Schools of this size are already large by the criteria employed by Barker and Gump (1964) in their seminal study of the effects of school size. That is, school consolidation over the last half century has caused a shift in the meaning of large and small within the context of the school size debate, at least within the state of Texas. Interpretation must also be tempered by the fact that the data are correlational. Inferences about causality, even to the specific population studied, are risky.

Academic Achievement

The most consistent findings were obtained for nationally standardized test scores. For both the SAT I and ACT African-American students enrolled in large schools fared better than African-American students at other schools. This finding is contrary to previous research on a national sample by Jewell (1989) in which SAT and ACT scores were higher in smaller schools. To the extent that the SAT I and ACT perform the intended function of predicting success in college, students from small schools may have a particularly difficult time should they decide to continue their education beyond high school. This is particularly disturbing given that African-American students, especially males, continue to be under served by higher education (Pascarella & Terenzini, 2005).

With regard to the TAAS, a state-wide standardized test, the advantage enjoyed by African-American students in large schools essentially disappeared. Although African-American students in large schools outperformed other African-American students on the reading assessment in 1998, this finding was not replicated in 1999 or 2000. No differences were found for reading or math in any year.

On the end of year exams African-American students in large schools had a consistent advantage over those African-American students in small schools in both Algebra I and U.S. History, and a less consistent advantage in these subjects over African-American students in medium size schools. Differences in Biology and English II were inconsistent and, if anything, showed a tendency to dissipate over time. These findings are somewhat inconsistent with those of Forbes, Fortune, and Packard (1993) who found that students enrolled in large schools earned higher grades in biology than students in small schools. Forbes et al. also found that students in large schools earned higher grades in physics. Although achievement in physics was not assessed in the present student, the higher end of the year grades in Algebra I for students in large schools would support better grades in physics.

The question, then, is how can these mixed results be explained? Given that the advantage found for large schools was unexpected, any interpretations are speculative. Nevertheless, there are a number of plausible explanations that can be used to guide future research.

One possibility is that results for both the TAAS and end of year exams are reported as passing rates rather than as specific scores. Given that the passing rate is 70%, these scores do not distinguish between students who score a 70% and students who score much higher. As a result, the data may not be sensitive enough to show consistent differences. More sensitive measures might show a more consistent advantage for large schools.

A second possibility is that the TAAS is a high stakes test designed to test achievement of minimum competency. As a result, all schools in Texas may place an equally heavy focus on the achievement of the skills needed to pass this test. For example, because biology is assessed on the TAAS, but physics and chemistry are not, all schools can be expected to place a heavy emphasis of biology. This focus could essentially drain the resources of smaller schools with larger schools having resources left over to go beyond minimum competencies. Thus, small schools may provide a substantially reduced curriculum in the physical sciences. Indeed, advocates of school consolidation have long argued that larger schools have the resources to offer a diverse curriculum that is lacking in small schools (Jackson, 1966; Roellke, 1996; Unks, 1989). Because both the TAAS and end of year exams are tied to state standards common to all Texas schools, focus on these standards could eliminate differences on the TAAS and substantially reduce differences on end of year exams. Scores on more general examinations such as the SAT I and ACT, however, would be more sensitive to broader based curricula. If this interpretation is correct, the recent trend toward using high stakes testing to evaluate school performance, as evidenced by No Child Left Behind, may have a particularly detrimental effect on the breadth of education received by African-American students in smaller secondary schools.

Attendance and Persistence

Students in small schools had the highest attendance rates in the two years for which data were available. This finding is consistent with previous research showing that small schools have a more positive climate than do large schools, resulting in increased attendance (Fetler, 1997; Fowler & Walberg, 1991; Howley, 1994; Jewell, 1989; Martin & Slate, 1998). In addition, absence from school may be more noticeable in small schools than in large schools creating more social pressure to attend school. These higher attendance rates, however, did not translate into an advantage in academic achievement that might be expected from increased presence in class.

Neither the higher attendance in small schools, nor the greater achievement in large schools, translated into an advantage in school completion. That is, both dropout rates and graduation rates did not differ by school size for any of the years for which data were available. These findings are inconsistent with a great deal of previous research which showed greater persistence in small schools (Fetler, 1997; Fowler & Walberg, 1991; Howley, 1994; Jewell, 1989; Martin & Slate, 1998). As already noted, however, the small schools in the present study all had enrollments over 400 students. Schools of this size are already “overmanned” (sic) by the criteria established in the seminal study of school size by Barker and Gump (1964). That is, there are far too many students for the opportunities available for active participation, thus marginalizing many students. As a result, even the schools defined as small by contemporary standards may have lost the holding power that once characterized small schools.

Absolute Performance Levels

Because the purpose for the present study was to compare schools of differing sizes we have discussed the results in relative terms. We would be remiss, however, if we did not make mention of the absolute level of performance exhibited by the students in the schools included in the study. For example, SAT I scores for small and medium schools hover near 800 and those scores in the large schools are at 868. In addition, large numbers of African-American students are failing both the TAAS and the end of the year examinations even though these tests are essentially minimum competency tests. The worse performance is in Algebra I for which passing rates range between 11.5% and 25.6%. Although there is an overall upward trend to these scores, they are simply unacceptable. Schools must do a better job of educating African-America students in essential knowledge and skills.

Implications for Future Research

Because a literature review by Slate and Jones (2005) indicated that African-American students may be particularly susceptible to the effects of school size, we specifically targeted this population for study. The fact that the results of this study are contrary to current trends in the literature raises important issues for research. Are the present results an anomaly related to the specific time period or schools studied or do these results represent a shift caused by changes in school size or curricula in recent years? Are the results specific to African-American students or do they apply to other racial and ethnic groups? Longitudinal research making direct comparisons of different racial and ethnic groups across multiple states will be needed to address these questions. Researchers in areas of significant population change should track student persistence and achievement as schools in those areas increase or decrease in size.

Additional variables will also need to be examined. Certainly, the differential effects of school size on boys and girls needs to be investigated. But, given the questions raised by the present study, researchers need to go beyond demographic characteristics to examine curricular variables as well. Although the relationship between school size and curriculum has been studied in the past (e.g., Barker & Gump, 1964; Jackson, 1966; Monk, 1987; Pittman & Haughwout, 1987; Turner & Thrasher, 1970; Walberg & Walberg, 1994), these studies were conducted before the current emphasis on evaluating schools through high stakes testing. Finally, examination of school size as it relates to student performance needs to occur at levels other than the secondary level. Limited information, at best, is available about the extent to which school size is related to student performance at the elementary or at the middle school levels.

Conclusion

Although a significant body of research on the effects of school size has accumulated since Barker and Gump's (1964) seminal study, these effects are still not well understood. We conducted the present study to begin clarification of the conditional effects of school size on African-American students. Because, contrary to recent trends, the results favor large schools, two possible explanations will require further investigation. Either the conditional effects of schools size for African-American students, and possibly other minorities, differ from the effects of schools size on white students, or recent changes in the educational system have caused a shift in the effects of school size. Regardless of which explanation is correct, schools of all sizes continue to serve African-American students poorly. Researchers must address these issues if social justice is to be achieved in our schools.

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Table 1

Percentage of Students on Free or Reduced Price Lunch

	School Size								
	Small			Medium			Large		
Year	*n*	Mean	*SD*	*n*	Mean	*SD*	*n*	Mean	*SD*
1998	239	33.4	17.2	62	34.2	20.1	192	35.7	25.4
1999	137	34.3	17.0	43	32.2	18.5	171	35.7	25.0
2000	238	34.4	17.0	65	32.4	19.4	199	36.8	25.6

Table 2

Scores on the SAT I by Year and School Size

	School Size								
	Small			Medium			Large		
Year	*n*	Mean	*SD*	*n*	Mean	*SD*	*n*	Mean	*SD*
1998	114	801.6	70.9	31	801.0	70.13	92	868.0	84.0
1999	90	803.2	72.1	30	796.6	68.2	117	868.0	83.7
2000	76	814.6	74.6	22	814.0	76.5	66	867.2	68.0

Table 3

Scores on the ACT by Year and School Size

	School Size								
	Small			Medium			Large		
Year	*n*	Mean	*SD*	*N*	Mean	*SD*	*n*	Mean	*SD*
1998	95	16.8	1.4	24	16.8	1.2	78	17.64	1.5
1999	75	16.8	1.4	26	16.7	1.2	96	17.6	1.5
2000	76	16.7	1.8	22	16.9	1.3	66	17.6	1.6

Table 4

Percent Passing the TAAS Exams by Year and School Size

	School Size					
	Small		Medium		Large	
Year	Mean	*SD*	Mean	*SD*	Mean	*SD*
1998						
Reading	74.0	17.6	74.1	11.8	79.7	10.0
Math	58.7	21.2	54.2	15.0	57.9	14.61
Writing	80.8	17.7	79.9	12.3	82.3	9.93
1999						
Reading	82.8	13.0	82.2	11.2	84.0	9.6
Math	67.7	19.7	69.5	13.1	67.9	13.7
Writing	88.6	12.1	88.2	8.3	87.1	7.9
2000						
Reading	85.4	13.0	83.3	10.0	86.8	9.6
Math	76.5	17.6	76.2	13.5	76.5	11.3
Writing	87.4	12.9	83.6	9.81	87.5	9.5

Table 5

Percent Passing the End of Year Exams by Year and School Size

	School Size					
	Small		Medium		Large	
Year	Mean	*SD*	Mean	*SD*	Mean	*SD*
1998						
Algebra I	11.52	13.9	13.2	13.4	16.1	13.5
Biology	60.0	19.0	56.1	14.5	64.5	12.9
1999						
Algebra I	19.1	18.2	18.0	16.1	25.56	18.6
Biology	59.8	19.7	59.2	16.1	63.7	13.7
English II	57.1	19.3	59.4	14.3	62.4	14.4
U.S. History	52.6	20.3	50.7	19.0	61.6	18.5
2000						
Algebra I	17.1	18.0	20.2	17.8	23.9	17.3
Biology	68.3	18.3	65.6	13.8	71.1	14.0
English II	67.5	19.2	63.7	16.3	69.4	15.9
U.S. History	50.8	19.2	57.6	16.0	63.7	17.4

Table 6

Available Attendance, Dropout, and Graduation Rates (Percentages) by Year and School Size

	School Size					
	Small		Medium		Large	
Year	Mean	*SD*	Mean	*SD*	Mean	*SD*
1998						
Attendance	94.5	2.5	93.0	3.1	93.0	2.7
Dropout	1.9	3.2	1.4	1.9	1.7	2.3
1999						
Attendance	94.9	1.8	94.1	2.7	93.0	2.6
Graduation	85.5	13.9	82.4	15.3	82.8	12.7
2000						
Dropout	1.4	3.5	1.9	2.8	1.7	2.1